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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Docket No. CHENG-105

NEW APPLICATION TRANSMITTAL

Commissioner of Patents and Trademarks
Washington, DC 20231

Sir:

Enclosed are:

(1) The papers required for a filing date under 37 CFR 1.53(b): (a) 8 pages of specification including 3 pages of claims with a total of 10 claims, with 2 independent and 8 dependent claims and (b) 1 sheets of informal drawing together with one page of abstract.

(2) Declaration.

(3) Small Entity Statement.


(4) Express Mail Certificate.

(5) A check in the amount of \$345 payable to the Commissioner of Patents and Trademarks for the basic filing fee of \$345 for a small entity.

Please address all correspondence and telephone calls to the undersigned.

Respectfully submitted,

Dated: March 10, 2000


Alexander L. Cheng, Applicant
11 Springdale Avenue
White Plains, N.Y. 10604
914-428-0299

Enclosures

jc713 U.S. PTO
03/10/00

jc135 U.S. PTO
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Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100
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METHOD AND APPARATUS FOR PARALLEL OPERATION IN A MULTIPLE ACCESS NETWORK

Express Mail Label Number: EI743670523US


CERTIFICATE OF MAILING UNDER 37 CFR 1.10

Sir:

Patent Application, Small Entity Statement and \$345 Check

Commissioner of Patents and Trademarks
Washington, D.C. 20231.

Dated: March 10, 2000


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Enclosures

**STATEMENT CLAIMING SMALL ENTITY STATUS
(37 CFR 1.9(f) & 1.27(b))--INDEPENDENT INVENTOR**

Docket Number (Optional)

CHENG - 105

Applicant, Patentee, or Identifier: Alexander L. Cheng

Application or Patent No.: _____

Filed or Issued: _____

Title: Method And Apparatus for Parallel Operation in a
Multiple Access Network

As a below named inventor, I hereby state that I qualify as an independent inventor as defined in 37 CFR 1.9(c) for purposes of paying reduced fees to the Patent and Trademark Office described in:

- ☒ the specification filed herewith with title as listed above.
☐ the application identified above.
☐ the patent identified above.

I have not assigned, granted, conveyed, or licensed, and am under no obligation under contract or law to assign, grant, convey, or license, any rights in the invention to any person who would not qualify as an independent inventor under 37 CFR 1.9(c) if that person had made the invention, or to any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).

Each person, concern, or organization to which I have assigned, granted, conveyed, or licensed or am under an obligation under contract or law to assign, grant, convey, or license any rights in the invention is listed below:

- ☒ No such person, concern, or organization exists.
☐ Each such person, concern, or organization is listed below.

Separate statements are required from each named person, concern, or organization having rights to the invention stating their status as small entities. (37 CFR 1.27)

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

Alexander L. Cheng

NAME OF INVENTOR

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Be it known that I, Alexander L. Cheng, a citizen of the Republic of China (Taiwan), residing at 11 Springdale Avenue, White Plains, New York, 10604, have invented new and useful improvements in a:

of which the following is a specification.

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100	2101	2102	2103	2104	2105	2106	2107	2108	2109	2110	2111	2112	2113	2114	2115	2116	2117	2118	2119	2120	2121	2122	2123	2124	2125	2126	2127	2128	2129	2130	2131	2132	2133	2134	2135	2136	2137	2138	2139	2140	2141	2142	2143	2144	2145	2146	2147	2148	2149	2150	2151	2152	2153	2154	2155	2156	2157	2158	2159	2160	2161	2162	2163	2164	2165	2166	2167	2168	2169	2170	2171	2172	2173	2174	2175	2176	2177	2178	2179	2180	2181	2182	2183	2184	2185	2186	2187	2188	2189	2190	2191	2192	2193	2194	2195	2196	2197	2198	2199	2200	2201	2202	2203	2204	2205	2206	2207	2208	2209	2210	2211	2212	2213	2214	2215	2216	2217	2218	2219	2220	2221	2222	2223	2224	2225	2226	2227	2228	2229	2230	2231	2232	2233	2234	2235	2236	2237	2238	2239	2240	2241	2242	2243	2244	2245	2246	2247	2248	2249	2250	2251	2252	2253	2254	2255	2256	2257	2258	2259	2260	2261	2262	2263	2264	2265	2266	2267	2268	2269	2270	2271	2272	2273	2274	2275	2276	2277	2278	2279	2280	2281	2282	2283	2284	2285	2286	2287	2288	2289	2290	2291	2292	2293	2294	2295	2296	2297	2298	2299	2300	2301	2302	2303	2304	2305	2306	2307	2308	2309	2310	2311	2312	2313	2314	2315	2316	2317	2318	2319	2320	2321	2322	2323	2324	2325	2326	2327	2328	2329	2330	2331	2332	2333	2334	2335	2336	2337	2338	2339	2340	2341	2342	2343	2344	2345	2346	2347	2348	2349	2350	2351	2352	2353	2354	2355	2356	2357	2358	2359	2360	2361	2362	2363	2364	2365	2366	2367	2368	2369	2370	2371	2372	2373	2374	2375	2376	2377	2378	2379	2380	2381	2382	2383	2384	2385	2386	2387	2388	2389	2390	2391	2392	2393	2394	2395	2396	2397	2398	2399	2400	2401	2402	2403	2404	2405	2406	2407	2408	2409	2410	2411	2412	2413	2414	2415	2416	2417	2418	2419	2420	2421	2422	2
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The present invention pertains generally to multiple access communication systems, and more specifically to a method and apparatus for improving quality-of-service (QoS) of a multiple access network.

The communication protocol provides the rules for communication. The protocols govern the behavior of each communicating node on how to access the network, how to signal other nodes of its current situation and need, how to transfer data, and unique to a multiple access network, how to detect and resolve contention (often called collision). To help manage the complexity of a communication system, it is customary to divide the functionality of a communication system in layers of protocols. The International Standard Organization has specified seven layers from lower to higher: physical, media access control (MAC) or link, network, transport, session, presentation, and application layers. The present invention deals mostly with the physical layer for multiple channels and the MAC layer protocol for access. The management issue, including quality-of-service (QoS) policy, is a concern to be dealt with by the higher layer protocol. The bandwidth of communication network is normally separated into two types of channels--signaling and traffic bearer. In some multiple access networks, e.g. Carrier Sense Multiple Access with Collision Detect (CSMA/CD), these two types of channels are one and the same.

Communication systems with multiple access network have been providing satisfactory services in many markets, such as local area network (LAN), cellular telephony, and more recently broadband network based on CATV infrastructure. More recently, galvanized by the potential of a broadband network, cable modems conforming to CableLabs' Data Over Cable Service Interface Specification (DOCSIS) have been deployed in increasing numbers. These multiple access protocols provide satisfactory services when the network load is light (actually

these networks are considered unstable if the usage reaches 80% of the maximum network throughput). Even with a light network load, there is no guarantee of QoS in these multiple access networks. At the same time, there is increasing pressure to put time-sensitive services, such as voice and video, on these networks. Moreover, during contention resolution phase, the services are interrupted.

The present invention overcomes the aforementioned limitations with the following objects:

- Efficient and flexible use of communication facilities;
- Compatible with and complementary to existing protocols;
- Enabling various service quality levels; and
- Providing seamless growth path.

Further objects and advantages of the present invention will become apparent from a consideration of the drawings and ensuing description thereof.

Discussion Of Prior Art

CSMA/CD is detailed in IEEE 802 series specification. DOCSIS is published by CableLabs.

There have been a number of proposals to improve the efficiency of a multiple access network. U.S. Patent No. 5,235,592 provides a circuit-based capability to token-bus protocol. U.S. Patent No. 5,319,641 offers a higher priority data transfer capability to standard CSMA/CD type protocol. There are also proposals to augment the standard protocol with special device. U.S. Patent No. 5,740,174 uses repeater and expansion bus to improve communication capability, while U.S. Patent No. 5,940,399 uses multi-port repeater for arbitration. Unique radio frequency signals are used in U.S. Patent No. 5,657,326 for wireless implementation of standard multiple access protocol.

U.S. Patent No. 5,563,883 provides a method for communication in a multiple access network and a dynamic bandwidth-on-demand scheme. U.S. Patent No. 5,793,307 offers a hybrid limited contention and polling scheme with similar motivation.

U.S. Patent No. 5,742,239 discloses a method to assign time slots to nodes in a multiple access network for arbitration. When the traffic on the network is light, defined by no request of use for a predefined number of time slots, any node can access the network using a collision-detection method, thereby improving the system performance.

U.S. Patent No. 5,544,158 discloses a multiple access method using "multiburst." The number of channels are fixed and limited. More specifically, ISDN's 2B+D is used.

Summary of the Invention

The present invention discloses a method and apparatus for improving communication in a multiple access system, which comprises a plurality of communicating nodes and a communication facility linking these nodes. One of the nodes can be assigned as a controller for management and operation purposes. The communication facility is built so that it has more than one channel for communication among nodes. Each node is assigned a regular communication channel and a contention-resolution channel. In some cases, these two types of channels can be one and the same. In the case of U.S. Patent No. 5,563,883, the regular communication channel comprises the primary and secondary (backup) communication channels. The contention resolution channels can be assigned dynamically to communicating nodes based on network condition, node behavior, and QoS policy.

When a collision is detected by the communicating nodes, nodes engaged in the contention switch to the contention-resolution channel for contention resolution process while nodes not engaged in the contention continue their normal operation in the regular channel. After the contention is resolved and communication is accomplished, the nodes that have switched will switch back to their regular channel. Any nodes with existing protocol will simply stay on the regular channel and resolve the contention in the existing fashion. Therefore, backward compatibility is achieved.

Therefore, the benefits of the present invention are:

- Flexibility – dynamic allocation of channels for contention vs. fixed assignment;
- Efficiency - parallel operation for non-contending nodes to reduce down-time of network;

in case of U.S. Patent No. 5,563,883. The nodes not involved in the contention and the nodes not having implemented the contention resolution channel scheme will continue with their normal operation on the regular channel with the existing protocol. This method allows a backward compatibility for communication nodes using existing protocol while offering a smooth migration for enhanced implementation.

In the case of U.S. Patent No. 5,563,883, the improvement of the contention resolution process is from $\log_2 N$ to $\log_2 N/X$ given there are X spare contention-resolution channels, which are equally distributed to all N nodes, which have the same probability of engaging in a contention. Meanwhile, the regular traffic is not interrupted.

It should be noted that, given that the same protocol is used in both regular and contention-resolution channels and the communicating nodes sharing the same behavior pattern, the patented multiple access system exhibits the same behavior probabilistically in the worst case. The improvement of network performance is derived from either the separation of communicating nodes into smaller group, or improved channel characteristics, i.e., transmission speed and quality. The present invention enables more efficient communication in reasonably loaded network while offering facility to provide different QoS levels.

From the foregoing, it will be observed that numerous variations and modifications may be effected without departing from the true spirit and scope of the novel concept of the invention. It should be understood that no limitation with respect to the specific structure and circuit arrangements illustrated is intended or should be inferred. It is, of course, intended to cover by the appended claims all such modifications as fall within the scope of the claims.

Thus, in accordance with the invention, a Method and Apparatus for Parallel Operation In A Multiple Access Network has been provided accomplishing all of the objects, and having the features and advantages specified at the beginning of this specification. It is to be understood that the disclosed construction of the invention may be embodied in other forms within the scope of the claims.

What is claimed is:

physical communication facility.

6. In a method of parallel operation in a multiple access network according to claim 1, said step of allocating contention resolution channel comprising the step of ensuring compatibility and non-interference with said regular communicating channel.
7. In a method of parallel operation in a multiple access network according to claim 1, said step of staying on said original channel comprising the step of maintaining the operation of existing protocol for communicating nodes which have not implemented the improved protocol or have not been involved in said contention.
8. In a method of parallel operation in a multiple access network according to claim 1, said step of performing contention resolution process comprising the step of implementing an improved contention resolution protocol.
9. In a method of parallel operation in a multiple access network according to claim 1, said step of performing contention resolution process comprising the step of maintaining the existing protocol as on said regular channel.
10. An apparatus of parallel operation in a multiple access network having a plurality of communicating nodes and communication network facilities comprising:
 - (a) allocating means for allocating a plurality of communicating channels in addition to a regular communicating channel some of which may be used as spare contention resolution channels;
 - (b) assigning means for assigning from said plurality of communicating channels dynamically to communicating nodes which have implemented improved protocol for contention resolution process;
 - (c) switching means for switching to assigned contention resolution channels upon detecting contention for nodes which have implemented improved protocol and involved in said contention;
 - (d) means for staying on said original channel for nodes which have not implemented improved protocol or have not involved in said contention;
 - (e) contention resolution means for performing contention resolution process on said

assigned contention resolution channels in parallel to the normal process on said regular channel;

- (f) reverting meaning for switching back to said regular channel upon completion of contention resolution process; and
- (g) resuming means for resuming normal process.

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Variable	Mean	SD	Min	Max	Skewness	Kurtosis	Normality
Age	34.5	10.5	18	65	-0.1	3.2	0.98
Gender	1.2	0.4	1	2	0.1	3.1	0.99
Marital Status	1.5	0.5	1	3	0.2	3.3	0.97
Education	12.5	2.5	8	16	-0.2	3.4	0.96
Income	15000	5000	5000	30000	0.3	3.5	0.95
Health	1.8	0.6	1	3	0.1	3.2	0.98
Stress	2.5	0.8	1	4	0.2	3.3	0.97
Depression	1.5	0.5	1	3	0.1	3.1	0.99
Life Satisfaction	3.5	1.0	1	5	-0.1	3.2	0.98
Work Satisfaction	3.0	0.9	1	5	0.1	3.3	0.97
Family Satisfaction	3.8	1.1	1	5	-0.2	3.4	0.96
Community Satisfaction	3.2	0.8	1	5	0.1	3.2	0.98
Overall Satisfaction	3.3	0.9	1	5	0.0	3.1	0.99

A communication system comprises a plurality of communicating nodes and communication facilities linking these nodes. The communication facility is constructed so that it has more than one channel for communication among these communicating nodes using many different means, such as with separate time slots, different frequency bands, coding scheme, separate physical media, or a combination of the above. Each node is assigned a regular communication channel and a contention-resolution channel. In some cases, these two types of channels can be one and the same.

The present invention offers a flexible way to adjust for network performance by dynamically allocating channels to be assigned dynamically to communicating nodes. The multiple access operation is improved via parallel operation for non-contending nodes, and smaller group of nodes for contention resolution. Support of different service quality levels based on varying group size is made possible in a multiple access network while providing compatibility with existing protocol. The present invention offers a smooth growth path for protocol and network facility.

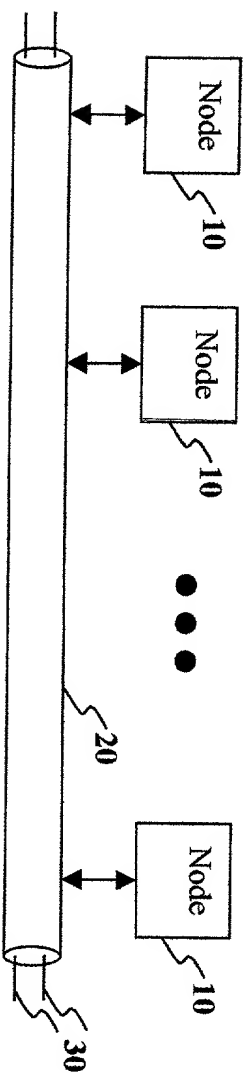
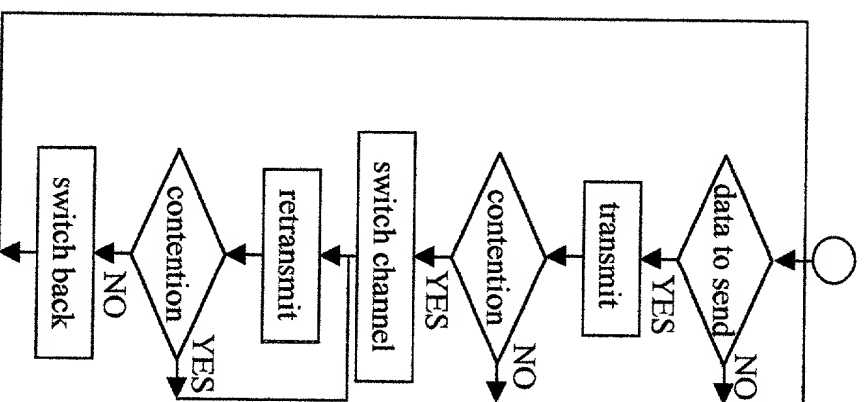


Fig. 1



Resolution
protocol on the
contention-
resolution
channel

Fig. 2

[illegible]

Inventor	Alexander L. Cheng
For	METHOD AND APPARATUS FOR PARALLEL OPERATION IN A MULTIPLE ACCESS NETWORK
Docket	Cheng-105

DECLARATION

I, ALEXANDER L. CHENG, hereby declare that I am a citizen of the Republic of China (Taiwan), residing at 11 Springdale Avenue, White Plains, New York 10604.

I believe that I am the original, first and sole inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled

METHOD AND APPARATUS FOR PARALLEL OPERATION IN A MULTIPLE ACCESS NETWORK


described and claimed in the accompanying application.

I hereby state that I have reviewed and understand the contents of the specification.

I acknowledge the duty to disclose information which is material to the examination of the application in accordance with Title 37, Code of Federal Regulations, Section 1.56(a).

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Dated: March 10, 2000


Alexander L. Cheng